

PATENT ABSTRACTS OF JAPAN

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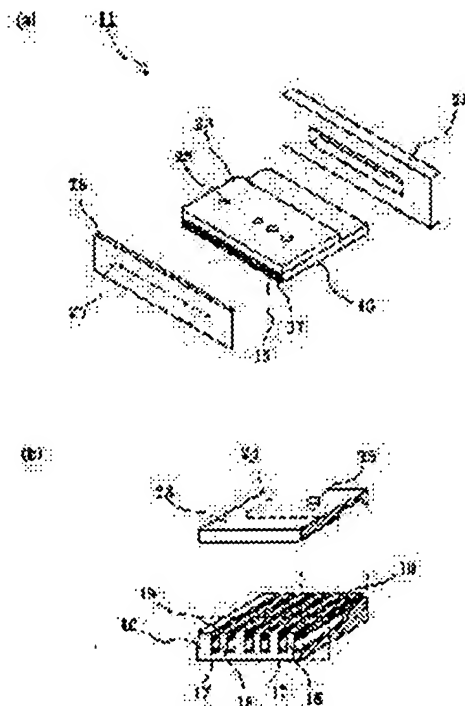
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(54) INK JET HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet head in which electrodes without flashes can be formed at low costs and good ink discharge characteristics can be maintained.

SOLUTION: Diaphragms 18 formed of a piezoelectric ceramic are arranged at predetermined intervals on a substrate. A chamber 17 is defined between the diaphragms 18. A volume inside the chamber 17 is changed by impressing a driving voltage to the electrode 19 set to a side face of the diaphragm 18, so that the ink filled in the chamber 17 is discharged from a nozzle opening 27. The electrode 19 in the ink jet head essentially consists of a 4A group metal.



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CLAIMS

[Claim(s)]

[Claim 1] The ink-jet head characterized by for said electrode to use 4A group's metal as a principal component in the ink-jet head which carries out the regurgitation of the ink with which the septum which consists of a piezo-electric ceramic on a substrate has been arranged at intervals of predetermined, the chamber was formed between each septum, the volume in said chamber was changed by impressing driver voltage to the electrode prepared in the side face of said septum, and the interior was filled up from a nozzle orifice.

[Claim 2] The ink jet head characterized by being chosen from the group which said metal becomes from titanium (Ti), a zirconium (Zr), and a hafnium (Hf) in claim 1.

[Claim 3] The ink jet head characterized by introducing oxygen into the metal which constitutes said electrode, and dissolving in claim 1 or 2.

[Claim 4] The ink jet head characterized by making oxygen dissolve to the metal concerned by vapor-depositing said metal by the low vacuum in claim 3.

[Claim 5] It is the ink jet head which sets they to be [any of claims 1-4], and is characterized by electrical resistivity being lower than said metal layer on a front face, and said electrode having the conductive layer of a thin film.

[Claim 6] The ink jet head to which said conductive layer is characterized by consisting of gold (Au) or platinum (Pt) in claim 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the ink jet head carried in the ink jet type recording apparatus applied to a printer, facsimile, etc.

[0002]

[Description of the Prior Art] The ink jet type recording device which records an alphabetic character and an image on recorded media using the ink jet head which has conventionally two or more nozzles which carry out the regurgitation of the ink is known. In this ink jet type recording apparatus, it is prepared in a head holder so that the nozzle of an ink jet head may counter recorded media, and this head holder is scanned in the direction which is carried in carriage and intersects perpendicularly with the conveyance direction of recorded media.

[0003] The decomposition outline of an example of such an ink jet head is shown in drawing 9, and an important section cross section is shown in drawing 10. As shown in drawing 9 R> 9 and drawing 10, two or more slots 102 are installed by the piezo-electric ceramic plate 101, and each slot 102 is separated into it by the side attachment wall 103. The longitudinal direction end section of each slot 102 is installed to the end side of the piezo-electric ceramic plate 101, the other end is not prolonged up to an other end side, but the depth is becoming shallow gradually. Moreover, a longitudinal direction is covered and the electrode 105 for drive electric-field impression is formed in the opening side front face of the both-sides wall 103 in each slot 102.

[0004] Here, such an electrode is formed of vacuum evaporation etc. after applying a resist generally in addition to the field in which the electrode of a piezo-electric ceramic plate is formed. Then, an electrode is formed in a predetermined field by removing and (lift off) carrying out a resist. Moreover, a piezo-electric ceramic plate is cut by predetermined die length near the opening side edge section of a slot after forming an electrode.

[0005] Moreover, the cover plate 107 is joined to the opening side of the slot 102 of the piezo-electric ceramic plate 101 through adhesives 109. In a cover plate 107, a slot 102 has the ink feed hopper 112 penetrated to an opposite direction from the pars basilaris ossis occipitalis of the ink room 111 used as the other end to which each slot 102 became shallow, and a crevice open for free passage, and this ink room 111.

[0006] Moreover, the nozzle plate 115 is joined to the end face in which the slot 102 of the zygote of the piezo-electric ceramic plate 101 and a cover plate 107 is carrying out opening, and the nozzle orifice 117 is formed in the location which counters each slot 102 of a nozzle plate 115.

[0007] In addition, in the field of the opposite side, the wiring substrate 120 has fixed [nozzle plate / 115 / of the piezo-electric ceramic plate 101] in the cover plate 107 in the opposite side. The wiring 122 connected to the wiring substrate 120 in each electrode 105 and bonding wire 121 grade is formed, and driver voltage can be impressed now to an electrode 105 through this wiring 122.

[0008] Thus, in the recording head constituted, if it is filled up with ink in each slot 102 from the ink feed hopper 112 and predetermined drive electric field are made to act on the side attachment wall 103

of the both sides of the predetermined slot 102 through an electrode 105, a side attachment wall 103 will deform, the volume in the predetermined slot 102 will change, and, thereby, the ink in a slot 102 will carry out the regurgitation from a nozzle orifice 117.

[0009] For example, as shown in drawing 11, in carrying out the regurgitation of the ink from the nozzle orifice 117 corresponding to slot 102a, while impressing forward driver voltage to the electrodes 105a and 105b in the slot 102a, it grounds the electrodes 105c and 105d which counter each. If the drive electric field of the direction which goes to slot 102a act on side attachment walls 103a and 103b by this and the direction of polarization of the piezo-electric ceramic plate 101 and this cross at right angles, it deforms in side-attachment-wall 103a and the direction of 103b fang furrow 102a according to the piezo-electric thickness skid effectiveness, and the volume in slot 102a will decrease, a pressure will increase, and ink will carry out the regurgitation from a nozzle orifice 117.

[0010]

[Problem(s) to be Solved by the Invention] Generally with such an ink jet head, aluminum (aluminum) is used as an electrode. Although electric resistance of aluminum is comparatively cheap low, in case an electrode is formed and lift off is specifically carried out, or in case a piezo-electric ceramic plate is cut, weld flash will occur. And a clearance or a float is made into an adhesion side in this weld flash, or the amount of flashes of adhesives becomes uneven by nozzle plate adhesion, and there is a problem that the fault of the ink regurgitation property in each slot not being equalized will arise.

[0011] Although generating of this weld flash can cancel the thickness of an electrode by making it thin, since the electric resistance of an electrode increases, a motion of a side attachment wall becomes late and it has the problem on which a regurgitation property deteriorates. Moreover, there is also a problem that connection between the electrode in wire bonding, an anisotropy lead-wire film tape, etc. and the circuit board becomes difficult.

[0012] Moreover, although generating of weld flash is also cancelable by vapor-depositing the electrode which consists of gold (Au) through a very thin adhesion layer (CrOx), there is a problem of considerable thickness being required in order to realize desired electric resistance, and being cost quantity.

[0013] This invention makes it a technical problem to offer the ink jet head which can form an electrode without weld flash by low cost in view of such a situation, and can hold a good ink regurgitation property.

[0014]

[Means for Solving the Problem] The 1st mode of this invention which solves the above-mentioned technical problem arranges the septum which consists of a piezo-electric ceramic on a substrate at intervals of predetermined. In the ink jet head which carries out the regurgitation of the ink with which the chamber was formed between each septum, the volume in said chamber was changed by impressing driver voltage to the electrode prepared in the side face of said septum, and the interior was filled up from a nozzle orifice. It is in the ink jet head characterized by said electrode using 4A group's metal as a principal component.

[0015] The 2nd mode of this invention is in the ink jet head characterized by being chosen from the group which said metal becomes from titanium (Ti), a zirconium (Zr), and a hafnium (Hf) in the 1st mode.

[0016] The 3rd mode of this invention is in the ink jet head characterized by introducing oxygen into the metal which constitutes said electrode, and dissolving in the mode of the 1st or 2.

[0017] The 4th mode of this invention is in the ink jet head characterized by making oxygen dissolve to the metal concerned by vapor-depositing said metal by the low vacuum in the 3rd mode.

[0018] the 5th mode of this invention -- which 1-4th voice -- it sets like and said electrode is in the ink jet head characterized by electrical resistivity being lower than said metal layer, and having the conductive layer of a thin film on a front face.

[0019] The 6th mode of this invention has said conductive layer in the ink jet head characterized by consisting of gold (Au) or platinum (Pt) in the 5th mode.

[0020] In this this invention, in case lift off or a piezo-electric ceramic plate is cut, generating of the

weld flash of an electrode is suppressed effectively.

[0021]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail based on the gestalt of operation of this invention. Of course, it cannot be overemphasized that this invention is not what is limited to this.

[0022] Drawing 1 is the decomposition perspective view of the ink jet head concerning 1 operation gestalt, drawing 2 is the decomposition perspective view of a head chip, drawing 3 is the expanded sectional view showing the important section of a head chip, and drawing 4 is the expanded sectional view showing the modification of a head chip.

[0023] As shown in drawing 1, the ink jet head 10 of this operation gestalt has the head chip 11, the base plate 12 of this head chip 11 prepared in a field side on the other hand, the cylinder-head cover 13 prepared in the another side side side of the head chip 11, and the wiring substrate 15 in which the drive circuit 14 grade for driving the head chip 11 was carried.

[0024] First, the structure of the head chip 11 is explained in detail. As shown in drawing 2 and drawing 3, two or more slots 17 are installed by the piezo-electric ceramic plate 16 which constitutes the head chip 11, and each slot 17 is separated into it by the side attachment wall 18. The longitudinal direction end section of each of these slots 17 is installed to the end side of the piezo-electric ceramic plate 16, the other end is not prolonged up to the other end side of the piezo-electric ceramic plate 16, but the depth is becoming shallow gradually. Each slot 17 formed in this piezo-electric ceramic plate 16 is formed by the discoid dice cutter, and although the part to which the depth became shallow gradually is unnecessary, it will be reluctantly formed of the configuration of a dice cutter.

[0025] Moreover, the opening side of a slot 17 is covered at a longitudinal direction, and the electrode 19 which impresses the electric field for making a side attachment wall 18 drive is formed in the side attachment wall 18 of the crosswise both sides in each [these] slot 17.

[0026] This electrode 19 has at least the metal layer 20 which consists of a metal (Ti), for example, the titanium, a zirconium (Zr), or a hafnium (Hf) of 4A group element etc. That is, the electrode 19 is using the metal of 4A group element as the principal component. By using as a principal component of an electrode 19, since it is lacking in the ductility in ordinary temperature as compared with aluminum, in case the metal of 4A group element forms an electrode 19, it can control that weld flash occurs.

[0027] Moreover, it is desirable for oxygen to be intentionally introduced into the metal layer 20 which constitutes such an electrode 19, and to dissolve. It can stiffen by this rather than the electrode which consists of a pure metal, and generating of weld flash can be controlled further. In addition, although not limited to the metal layer 20 especially as an approach of making oxygen dissolving, oxygen can be made to dissolve by vapor-depositing a metal by the low vacuum, for example, 1.0×10^{-2} - 1.0×10^{-4} [Pa] extent.

[0028] In addition, the conductive layer 21 which consists of a conductive high ingredient (Au), for example, gold, or platinum (Pt) etc. further is formed, and you may make it constitute electrode 19A from a metal layer 20 and a conductive layer 21 on such a metal layer 20, as shown in drawing 4. Such electric resistance of electrode 19A of a configuration turns into combined resistance of the electric resistance of the metal layer 20, and the electric resistance of a conductive layer 21. Therefore, even if the thickness of a conductive layer is comparatively thin, the desired electric resistance value as an electrode is realizable. The ink jet head which has a good ink regurgitation property by low cost is realizable rather than it forms the electrode which consists only of expensive metals, such as gold or platinum, by this.

[0029] Moreover, although the metal of 4A group element which is the principal component of an electrode 19 is a metal which is easy to carry out self-passivation from the first, it is that the high conductive layer 21 which consists of a still more **** metal is vapor-deposited by the front face, and passivation is promoted and the corrosion resistance of an electrode is improved.

[0030] As the formation approach of such an electrode 19, first, as the resist etc. was applied and mentioned above on the front face of the piezo-electric ceramic plate 16, a slot 17 is formed by a dice cutter etc. As shown in drawing 5 (a), while each slot 17 and a side attachment wall 18 are formed by

this, the mask 22 which consists of a resist remains on each side attachment wall 18. subsequently, the thing for which the vacuum evaporation from [well-known] slant is twice performed as shown in drawing 5 (b) -- the metal layer 20 is formed in a part of front face of a side attachment wall 18. And as shown in drawing 5 (c), the metal layer 20 on a side attachment wall 18 is removed by removing the mask 22 of piezo-electric ceramic plate 16 front face (lift off).

[0031] It is not necessary to carry out lift off of the mask 22 of the end face (opening side of a slot 17) of the piezo-electric ceramic plate 16, and at this time, as shown in drawing 6, it is removed by coincidence by cutting the piezo-electric ceramic plate 16 to predetermined die length near [that] the edge after that. Thereby, an electrode 19 is formed in the predetermined field of the piezo-electric ceramic plate 16.

[0032] Moreover, the ink room plate 23 is joined to the opening side of the slot 17 of the piezo-electric ceramic plate 16 in which the slot 17 and the electrode 19 grade were formed in this way. On the ink room plate 23, a slot 17 has the ink feed hopper 25 penetrated to an opposite direction from the pars basilaris ossis occipitalis of the ink room 24 used as the other end to which each slot 17 became shallow, and a crevice open for free passage, and this ink room 24.

[0033] Here, with this operation gestalt, each slot 17 is divided into black (B), yellow (Y), MAZENDA (M), and the group corresponding to the ink of each color of cyanogen (C), and the ink room 24 and every four ink feed hoppers 25 are formed, respectively.

[0034] In addition, although it can be formed on a ceramic plate, a metal plate, etc., as for the ink room plate 23, it is desirable [considering the deformation after junction to the piezo-electric ceramic plate 16 etc.] to use the ceramic plate which coefficient of thermal expansion approximated.

[0035] Moreover, the nozzle plate 26 is joined to the end face in which the slot 17 of the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23 is carrying out opening, and the nozzle orifice 27 is formed in the location which counters each slot 17 of a nozzle plate 26.

[0036] With this operation gestalt, the nozzle plate 26 is larger than the area of the end face in which the slot 17 of the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23 is carrying out opening. This nozzle plate 26 uses for example, excimer laser equipment for a polyimide film etc., and forms a nozzle orifice 27. Moreover, although not illustrated, in order to prevent adhesion of ink etc., the water-repellent film which has water repellence is prepared in the field which counters the printed matter-ed of a nozzle plate 26.

[0037] In addition, with this operation gestalt, the nozzle buttress plate 28 is arranged around the edge as for which the slot 17 of the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23 is carrying out opening. This nozzle buttress plate 28 is for being joined to the outside of the zygote end face of a nozzle plate 26, being stabilized and holding a nozzle plate 26.

[0038] Such a head chip 11 of a configuration joins the piezo-electric ceramic plate 16 and the ink room plate 23, and joins a nozzle plate 26 to the end face of the zygote. Subsequently, it is formed in the lateral surface of a nozzle plate 26, and the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23 by carrying out fitting adhesion of the nozzle buttress plate 28.

[0039] The ink jet head 10 of this operation gestalt which used such a head chip 11 for below is explained.

[0040] As shown in drawing 1 and drawing 7, with the nozzle orifice 24 side of the piezo-electric ceramic plate 16 with which the ink jet head 10 of this operation gestalt constitutes the head chip 11, the circuit pattern which is connected to an electrode 19 and which is not illustrated is formed in the edge of the opposite side, and the flexible cable 30 is joined to this circuit pattern through the anisotropy electric conduction film 29. Moreover, the base plate 12 made from the aluminum by the side of the piezo-electric ceramic plate 16 and the cylinder-head cover 13 by the side of the ink room plate 23 are attached to the back end side of the nozzle buttress plate 28 of the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23. It is fixed by engaging stop shaft 13a of a cylinder-head cover 13 with stop hole 12a of a base plate 12, and a base plate 12 and a cylinder-head cover 13 pinch the zygote of the piezo-electric ceramic plate 16 and the ink room plate 23 in both. The ink installation way 31 which is open for free passage to each of the ink feed hopper 25 of the ink room plate 23 is established in the

cylinder-head cover 13.

[0041] Moreover, as shown in drawing 7, the wiring substrate 15 fixes on the base plate 12 projected to the back end side of the piezo-electric ceramic plate 16. Here, on the wiring substrate 15, the drive circuit 14 which has the drive IC for driving the head chip 11 is carried, the drive circuit 14 and the flexible cable 30 are connected through the anisotropy electric conduction film 32, and the ink jet head 10 is completed by this.

[0042] With such an ink jet head 10, by being filled up with ink in each slot 17 from the ink feed hopper 25 through the ink installation way 31, and making predetermined drive electric field act on the side attachment wall 18 of the both sides of the predetermined slot 17 through an electrode 19 by the drive circuit 14, a side attachment wall 18 deforms, the volume of the predetermined slots 17 changes, and the ink in a slot 17 carries out the regurgitation from a nozzle orifice 27.

[0043] As mentioned above, although the configuration of the ink jet head of this operation gestalt was explained, in such an ink jet head, the electrode of the following examples 1-4 was created, and the generating situation of a thing and weld flash in which the electrode of the example of a comparison was formed was compared.

[0044] (Example 1) As mentioned above, the metal layer (electrode) was formed with electron beam vacuum deposition (the EB method) after forming a mask in the predetermined field of a piezo-electric ceramic plate. That is, after installing the piezo-electric ceramic plate in the chamber and baking a chamber at temperature lower enough than the Curie temperature of a piezo-electric ceramic plate, the inside of a chamber was exhausted to 1.0×10^{-5} [Pa] which is once an ultra-high-vacuum field, argon (Ar) gas was introduced after that, Bonn Bart was performed, and the piezo-electric ceramic plate was cleaned. Subsequently, the inside of the chamber which has arranged the piezo-electric ceramic plate is exhausted below to 1.0×10^{-5} [Pa] which is an ultra-high-vacuum field again. Subsequently, the metal layer of thickness 750 [about] [nm] was formed on condition that acceleration voltage 10 [kV] and the beam current 250 [mA] by vapor-depositing titanium (Ti) of 99.5% of purity to both sides of a side attachment wall 18. Then, as mentioned above, cutting of lift off and a piezo-electric ceramic plate was performed, and it considered as the electrode of an example 1.

[0045] (Example 2) Where the inside of a chamber is exhausted to 4.0×10^{-4} [Pa] extent, the metal layer was vapor-deposited, and except introducing oxygen and having made it make it dissolve intentionally in a metal layer using degasifying (mainly moisture) from a chamber, it formed like the example 1 and considered as the electrode of an example 2.

[0046] (Example 3) Except having vapor-deposited gold (Au) on the front face of the metal layer which consists of titanium of the thickness 750 [nm] vapor-deposited in the example 1 with electron beam vacuum deposition (the EB method), and having formed the high conductive layer of thickness 200 [about] [nm] in it continuously, without carrying out the vacuum break in a chamber, it formed like the example 1 and considered as the electrode of an example 3.

[0047] (Example 4) Except having vapor-deposited platinum (Pt) on the front face of the metal layer which consists of titanium of the thickness 750 [nm] vapor-deposited in the example 1 with electron beam vacuum deposition (the EB method), and having formed the 2nd metal layer of thickness 100 [about] [nm] in it continuously, without carrying out the vacuum break in a chamber, it formed like the example 1 and considered as the electrode of an example 4.

[0048] (Example of a comparison) Except having vapor-deposited the aluminum (aluminum) which is 99.995% of purity to both sides of a side attachment wall on condition that the acceleration voltage 10 [kV] beam current 400 [mA], and having formed the electrode layer of thickness 750 [about] [nm], it formed like the example 1 and the electrode of the example of a comparison took after exhausting the inside of a chamber below to 1.0×10^{-4} [Pa].

[0049] (Example of a trial) As a result of measuring investigation of the content of oxygen, and the electric resistance value of each electrode by 4 terminal method by Auger electron analysis (AES) about the electrode of these examples 1-4 and the example of a comparison, the result of having investigated the generating situation of weld flash in the list is shown in the following table 1. Moreover, the condition of the end side of the piezo-electric ceramic plate in which the electrode of an example 2 and

the example of a comparison was formed is shown in drawing 8.

[0050]

[Table 1]

	材料	電極		パリの発生状況	評価
		酸素含有量 [at%]	(合成)抵抗率 [$\mu\Omega\cdot\text{cm}$]		
実施例 1	チタ	4	168	ほとんど発生しない	○
実施例 2	チタ	18	1,120	全く発生しない	◎
実施例 3	チタ/金	4	6.3	ほとんど発生しない (希にあっても数 μm 程度)	○
実施例 4	チタ/白金	4	60.4	ほとんど発生しない (希にあっても数 μm 程度)	○
比較例	アルミ	—	3.6	全面で数十 μm のパリが発生	×

generating situation evaluation ingredient oxygen content [at%] (composition) resistivity [$\mu\Omega\cdot\text{cm}$] example 1 titanium 4168 of electrode weld flash -- O example 2 hardly generated titanium 181,120 -- the O example 3 titanium / gold 46.3 which is not generated at all -- it hardly generates (even if it is rarely) several -- about [micrometer] O example 4 titanium / platinum 450.4, as dozens of micrometers weld flash shows in the generating x table 1 in the hardly generated example aluminum of O (even if it is rarely about several micrometers) comparison-3.6 all slot It turned out that a little (4 [at%] extent (relative sensibility amendment atomic ratio)) oxygen contains comparatively in the electrode of examples 1, 3, and 4, and comparatively a lot of oxygen (18 [at%] extent) contains in it at the electrode of an example 2 (Auger-electron-spectroscopy analysis (AES)). Moreover, when the electrode of each example was investigated with the X-ray diffraction method (XRD law), only the diffraction pattern single phase of titanium (hexagonal system) was checked, and dissolving only in the metal layer which oxygen becomes from titanium was shown.

[0051] As shown in the electrode of such examples 1-4 at drawing 8 (a), it turns out that weld flash hardly occurs and the electrode is formed good. On the other hand, as shown in the electrode of the example of a comparison at drawing 8 (b), dozens of micrometers weld flash had occurred into all slots.

[0052] With the ink jet head of this invention, generating of the weld flash of an electrode is controlled and a good ink regurgitation property can be acquired so that clearly from this. In addition, resistivity will become very large, although the electrode of an example 2 does not have generating of weld flash and the electrode is formed very good. For this reason, since the time constant in the drive of a side attachment wall increases, to high-speed operation, it is unsuitable.

[0053] Moreover, as a principal component of an electrode, you may be a zirconium (Zr) and a hafnium (Hf) and, of course, it is possible by increasing the beam current, although each above-mentioned example showed the example which formed the electrode by using titanium as a principal component to form the good electrode which does not have weld flash like an above-mentioned example in this case.

[0054]

[Effect of the Invention] As explained above, since the electrode is using the metal of 4A group element as the principal component, in case lift off is carried out, or in case it cuts a piezo-electric ceramic plate, in this invention, weld flash hardly generates it in an electrode. Thereby, while being able to hold an ink regurgitation property good, the ink regurgitation property in each slot can be equalized.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the ink jet head carried in the ink jet type recording apparatus applied to a printer, facsimile, etc.

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PRIOR ART

[Description of the Prior Art] The ink jet type recording device which records an alphabetic character and an image on recorded media using the ink jet head which has conventionally two or more nozzles which carry out the regurgitation of the ink is known. In this ink jet type recording apparatus, it is prepared in a head holder so that the nozzle of an ink jet head may counter recorded media, and this head holder is scanned in the direction which is carried in carriage and intersects perpendicularly with the conveyance direction of recorded media.

[0003] The decomposition outline of an example of such an ink jet head is shown in drawing 9, and an important section cross section is shown in drawing 10. As shown in drawing 9 R> 9 and drawing 10, two or more slots 102 are installed by the piezo-electric ceramic plate 101, and each slot 102 is separated into it by the side attachment wall 103. The longitudinal direction end section of each slot 102 is installed to the end side of the piezo-electric ceramic plate 101, the other end is not prolonged up to an other end side, but the depth is becoming shallow gradually. Moreover, a longitudinal direction is covered and the electrode 105 for drive electric-field impression is formed in the opening side front face of the both-sides wall 103 in each slot 102.

[0004] Here, such an electrode is formed of vacuum evaporation etc. after applying a resist generally in addition to the field in which the electrode of a piezo-electric ceramic plate is formed. Then, an electrode is formed in a predetermined field by removing and (lift off) carrying out a resist. Moreover, a piezo-electric ceramic plate is cut by predetermined die length near the opening side edge section of a slot after forming an electrode.

[0005] Moreover, the cover plate 107 is joined to the opening side of the slot 102 of the piezo-electric ceramic plate 101 through adhesives 109. In a cover plate 107, a slot 102 has the ink feed hopper 112 penetrated to an opposite direction from the pars basilaris ossis occipitalis of the ink room 111 used as the other end to which each slot 102 became shallow, and a crevice open for free passage, and this ink room 111.

[0006] Moreover, the nozzle plate 115 is joined to the end face in which the slot 102 of the zygote of the piezo-electric ceramic plate 101 and a cover plate 107 is carrying out opening, and the nozzle orifice 117 is formed in the location which counters each slot 102 of a nozzle plate 115.

[0007] In addition, in the field of the opposite side, the wiring substrate 120 has fixed [nozzle plate / 115 / of the piezo-electric ceramic plate 101] in the cover plate 107 in the opposite side. The wiring 122 connected to the wiring substrate 120 in each electrode 105 and bonding wire 121 grade is formed, and driver voltage can be impressed now to an electrode 105 through this wiring 122.

[0008] Thus, in the recording head constituted, if it is filled up with ink in each slot 102 from the ink feed hopper 112 and predetermined drive electric field are made to act on the side attachment wall 103 of the both sides of the predetermined slot 102 through an electrode 105, a side attachment wall 103 will deform, the volume in the predetermined slot 102 will change, and, thereby, the ink in a slot 102 will carry out the regurgitation from a nozzle orifice 117.

[0009] For example, as shown in drawing 11, in carrying out the regurgitation of the ink from the nozzle orifice 117 corresponding to slot 102a, while impressing forward driver voltage to the electrodes

105a and 105b in the slot 102a, it grounds the electrodes 105c and 105d which counter each. If the drive electric field of the direction which goes to slot 102a act on side attachment walls 103a and 103b by this and the direction of polarization of the piezo-electric ceramic plate 101 and this cross at right angles, it deforms in side-attachment-wall 103a and the direction of 103b fang furrow 102a according to the piezo-electric thickness skid effectiveness, and the volume in slot 102a will decrease, a pressure will increase, and ink will carry out the regurgitation from a nozzle orifice 117.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, since the electrode is using the metal of 4A group element as the principal component, in case lift off is carried out, or in case it cuts a piezo-electric ceramic plate, in this invention, weld flash hardly generates it in an electrode. Thereby, while being able to hold an ink regurgitation property good, the ink regurgitation property in each slot can be equalized.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Generally with such an ink jet head, aluminum (aluminum) is used as an electrode. Although electric resistance of aluminum is comparatively cheap low, in case an electrode is formed and lift off is specifically carried out, or in case a piezo-electric ceramic plate is cut, weld flash will occur. And a clearance or a float is made into an adhesion side in this weld flash, or the amount of flashes of adhesives becomes uneven by nozzle plate adhesion, and there is a problem that the fault of the ink regurgitation property in each slot not being equalized will arise.

[0011] Although generating of this weld flash can cancel the thickness of an electrode by making it thin, since the electric resistance of an electrode increases, a motion of a side attachment wall becomes late and it has the problem on which a regurgitation property deteriorates. Moreover, there is also a problem that connection between the electrode in wire bonding, an anisotropy lead-wire film tape, etc. and the circuit board becomes difficult.

[0012] Moreover, although generating of weld flash is also cancelable by vapor-depositing the electrode which consists of gold (Au) through a very thin adhesion layer (CrOx), there is a problem of considerable thickness being required in order to realize desired electric resistance, and being cost quantity.

[0013] This invention makes it a technical problem to offer the ink jet head which can form an electrode without weld flash by low cost in view of such a situation, and can hold a good ink regurgitation property.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the decomposition perspective view of the ink jet head concerning 1 operation gestalt of this invention.

[Drawing 2] It is the decomposition perspective view and sectional view of a head chip concerning 1 operation gestalt of this invention.

[Drawing 3] It is the sectional view showing the important section of the head chip concerning 1 operation gestalt of this invention.

[Drawing 4] It is the sectional view showing other examples of the head chip concerning 1 operation gestalt of this invention.

[Drawing 5] It is the sectional view showing the production process of the ink jet head concerning 1 operation gestalt of this invention.

[Drawing 6] It is the sectional view showing the production process of the ink jet head concerning 1 operation gestalt of this invention.

[Drawing 7] It is the perspective view in which it is shown like the erector of the ink jet head concerning 1 operation gestalt of this invention.

[Drawing 8] It is the sectional view showing the important section of the ink jet head of an example 2 and the example of a comparison.

[Drawing 9] It is the decomposition perspective view showing the outline of the recording head concerning the conventional technique.

[Drawing 10] It is the sectional view showing the outline of the recording head concerning the conventional technique.

[Drawing 11] It is the sectional view showing the outline of the recording head concerning the conventional technique.

[Description of Notations]

10 Ink Jet Head

11 Head Chip

12 Base Plate

13 Cover Plate

16 Piezo-electric Ceramic Plate

17 Slot

18 Side Attachment Wall

19 19A Electrode

20 Metal Layer

23 Ink Room Plate

24 Ink Room

25 Ink Feed Hopper

26 Nozzle Plate

27 Nozzle Orifice

[Translation done.]

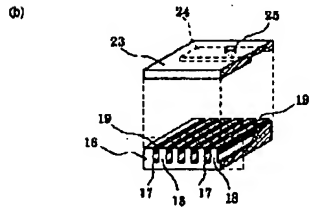
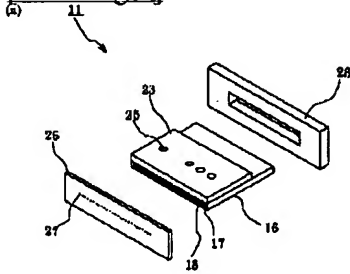
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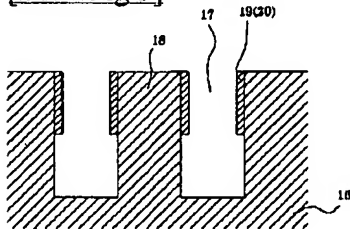
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DRAWINGS

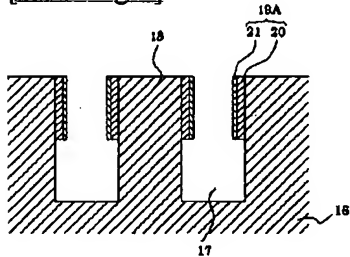
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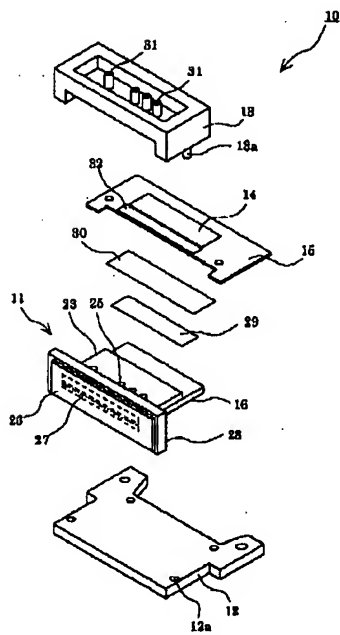
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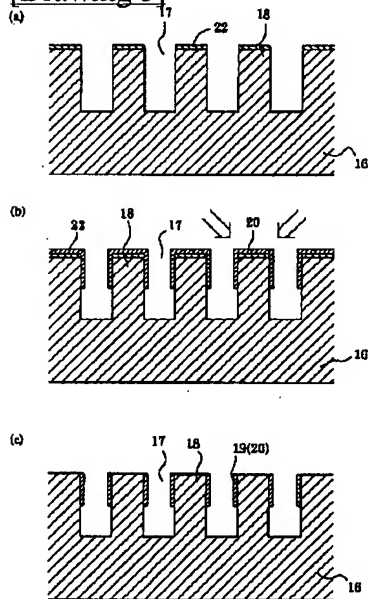
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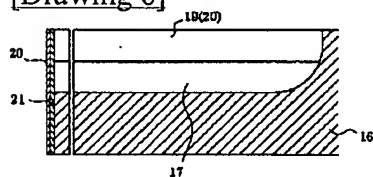
[Drawing 1]



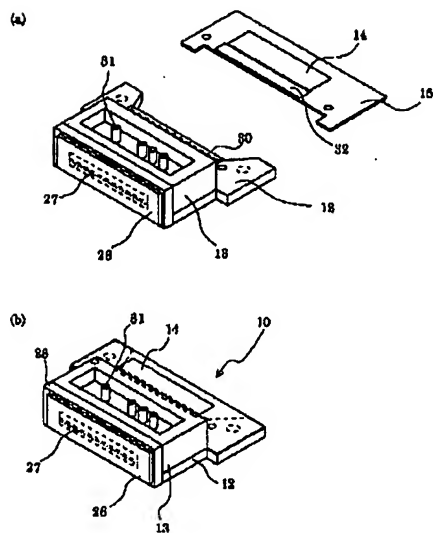
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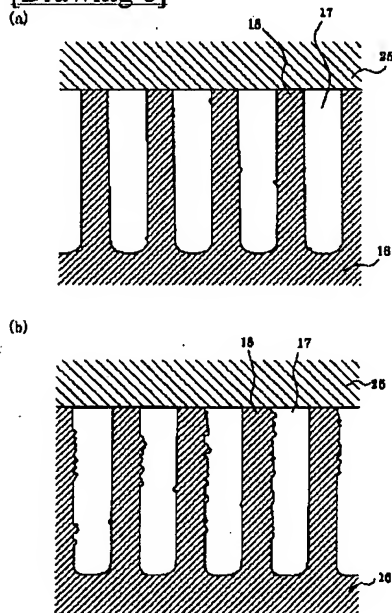
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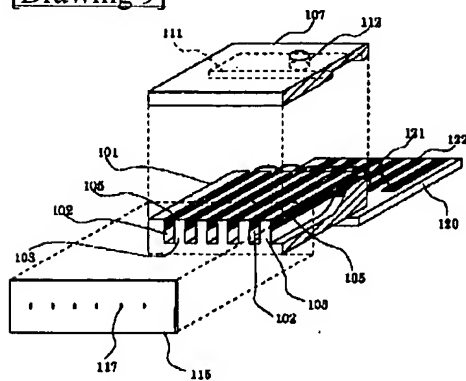
[Drawing 7]



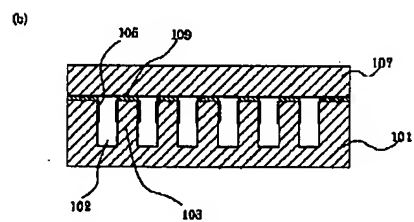
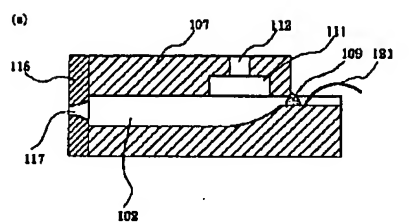
[Drawing 8]



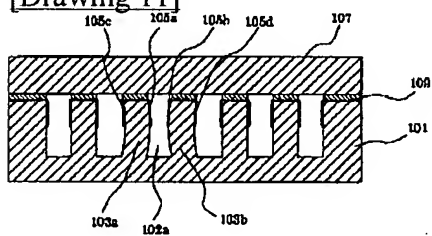
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]